Mechanical Damage Inspection Using MFL Technology
Agreement DTRS56-02-T-0002
5th Quarterly Status Report
Period October 1 to December 31, 2003
Contractor: Battelle

The goal of this project is to design an improved magnetic flux leakage inspection system for mechanical damage. We have completed work on the magnetizer and sensor designs for the simplified multiple magnetization tool.

Finite element modeling has shown that a single magnetizer with three poles is the most effective design. Two-pole magnetizer designs could not be tuned to attain the high and low field levels required for characterization of mechanical damage defects. A four-pole system, essentially two separate magnetizers, was examined as a baseline. This design demonstrated some unfavorable characteristics when the magnetizers were within a foot of each other. At this distance, the high and low magnetizers interacted causing non-uniform fields for the low level magnetizer. When the magnetizers were brought even closer, the unit behaved like a three pole system.

Deformation sensors have also been designed to measure the physical geometry of dents. These sensors measure the change in angle of the arm that holds the sensor against the pipe surface. In most electronic equipment, angles are measured to a high degree of precision using potentiometers. However the moving parts in these devices often fail in the abusive pipeline environment. Our design meets the measurement requirements while having no additional moving parts. The deformation sensor uses a small high strength magnet and magnetic field sensor, the same sensors that measure the flux leakage signals. The design is based on rotation of a magnet relative to the sensor. The sensor and magnets can be embedded in the flux leakage sensors system. These sensors themselves have no additional moving parts and will easily survive pipeline environment.

Point of Contact:
J. Bruce Nestleroth
Battelle
505 King Ave.
Columbus, Ohio 43201
nestlero@battelle.org
Voice: 614-424-3181
Fax: 614-458-3181